The Evolution of the Emergency Communications Ecosystem

It continues, but needs to accelerate to take advantage of emerging opportunities—in this whitepaper we examine the critical factors affecting future evolution, and the key actions needed to accomplish it.

Introduction

Sooner or later, most everything evolves. Typically, evolution is driven by a need to adapt to changing environmental conditions. Just as typically, things that evolve get stronger, and become more resilient and adept—all of which contributes mightily to their ability not only to survive but also to thrive in their new environment. In contrast, things that do not evolve tend to weaken over time and often disappear.

Consider the single human cell. Billions of them exist in the human body, and each one has a specific purpose and the ability to sustain itself. But inevitably, conditions within the body change over time, and how the cell reacts to this change is critical. When faced with new circumstances that will jeopardize its purpose and/or self-sustainability—or worse, cause its demise— cells often will seek out other like cells and then merge with them, forming a larger, stronger and more complex cell capable of doing more. As more cells merge into it, the complex cell continues to strengthen and becomes even more resilient and complex, improving its chances of survival and often further expanding its purpose.

Now let's apply that analogy to the 6,000-plus public safety answering points (PSAPs) that are spread across the nation. While a modicum of evolution has occurred in them—for instance, the advent of computer-aided dispatch (CAD)—today's PSAPs arguably are not very different from what they were when they first appeared on the scene a half century ago. They still, for the most part, are standalone islands of communication (i.e., single cells), and they still serve the same basic function, which is to receive 911 voice calls from the public, process them, and then dispatch the appropriate emergency response.

However, the public safety sector has reached an inflection point. Technology has evolved dramatically, particularly over the last decade, and the needs and expectations of the public served by PSAPs have evolved as well. Regarding emergency response, data has overtaken voice in terms of importance. Consequently, PSAPs need systems that are capable of leveraging the enormous amount of data that already is available yet

MissionCritical**Partners**

inaccessible by PSAPs today, a treasure trove of emergency-response-enhancing information that will increase exponentially as time passes. They also need to jettison the legacy analog call-handling equipment that has existed for the last 50 years, and replace it with new equipment capable of natively processing calls and data that originate from digital, Internet Protocol (IP)-based devices.

This whitepaper explores the factors driving the need for PSAP evolution, and provides insight into how to accomplish it.

Driving Factors

Today, roughly 70 percent of 911 calls are placed from digital, IP devices, i.e., wireless and voice over IP (VoIP) phones. Such calls have to go through a digital-to-analog conversion before they can be received by the PSAP. Only voice can be delivered with such calls—critical call data, notably location information, only can be retrieved through a series of database queries, which introduces additional points of failure into the process. Sometimes, this mission-critical data, which is vital to the task of determining the appropriate emergency response, cannot be retrieved. Even when it can, time has been added to the process, a critical consideration when lives and property are at grave risk and every second matters.

This situation can have a detrimental effect on the quality of emergency response received by the public. For that reason, the evolution of the emergency communications ecosystem needs to begin with the retirement of PSAP legacy communications systems with a concurrent migration to systems capable of handling emergency calls in a Next Generation 911 (NG911) environment.

Speaking of NG911, it is a change agent that will—along with the nationwide public safety broadband network (NPSBN) being implemented by the First Responder Network Authority (FirstNet)—push the emergency communications ecosystem evolution further forward. Both networks are IP-based and broadband-enabled, which means they will be able to transmit high-bandwidth, information-rich data files, such as video, that would choke legacy narrowband data communications systems. The accessibility of such information to 911 telecommunicators and first responders in the field will bring situational awareness and operational efficiency to new levels, which in turn will improve emergency response significantly.

But the data envisioned to traverse NG911 systems and the NPSBN in the future only represents the tip of a very large iceberg in terms of the information that could be available to PSAPs right now if they were properly equipped to receive and process the information flow.

According to Tony Seba, the Stanford University instructor and author whose lectures on disruptive innovation are renowned, more than 10 billion sensors are in place and generating data today. He projects that this number will continue to grow exponentially in the coming years, eventually reaching into the trillions. These sensors generate a tremendous amount of data that, if harnessed, would have a seismic impact on emergency response. For example:

- Real-time traffic data generated by sensors embedded in roadways and via crowd-sourcing applications could be used by 911 telecommunicators to reroute emergency responders away from areas of heavy congestion, which would get them to the incident faster.
- Stream and river gauges provide data that would allow emergency management officials to order flood evacuations earlier.
- The same holds true for atmospheric sensors placed in chemical plants and the surrounding community, as well as leak-detection sensors employed by natural gas utilities.

The evolution needs to begin with the retirement of PSAP legacy communication systems with a concurrent migration to an NG911 environment.

Community-based sensors could have a seismic impact on emergency response, if accessible, actionable and prioritized, for public safety.

MissionCriticalPartners

- The aggregated data generated by weather stations located throughout a county, or counties, could provide officials with advance warning, even before the National Weather Service, that a dangerous storm system—perhaps one capable of spawning a tornado—is heading in their direction. This not only would enable them to alert the citizenry earlier, but also to get a jump on marshalling the resources necessary for the potential response.
- Personal health devices, such as heart monitors, have embedded sensors that generate biometric data. Such data could be used to alert a PSAP that the wearer is about to have a cardiac event, enabling first responders to be dispatched immediately, before the event occurs—again, in such scenarios, every second counts.

Meanwhile, social media represents a tremendously effective, but virtually untapped resource. The aftermath of the magnitude 7.0 earthquake that decimated Haiti in 2010 provides a powerful example. Tufts University graduate students used the Ushahidi crowd-sourcing platform to algorithmically sift through millions of social-media interactions to identify actionable items—essentially, if enough people were talking about something over social media, the information was thought to be viable. Later the Tufts students determined, based on social-media-generated data, that signs of life were being reported in areas that were not scheduled for search in the short term. Based on this critical intelligence, rescuers changed their course of action, and soon after media were reporting that survivors were being found as a result.

Two years later, Indianapolis, Indiana, public-safety agencies collaborated to create a command post specifically to monitor social-media chatter in the two weeks leading up to, and then during, the Super Bowl when it was held in the city's Lucas Oil Stadium. Volunteers used algorithms to monitor numerous social-media platforms. In addition, word-cloud technology was used to determine what was trending based on the chatter.

Clearly, new types of data have emerged that would improve emergency response by leaps and bounds—if only PSAPs had access to the information that already is available from a variety of sources. For that to occur, PSAP officials will need to start thinking and acting very differently than they have historically.

Call to Action

The evolution of the emergency communications ecosystem—which is a prerequisite to harnessing the power of data—will result in PSAPs and telecommunicators that will look and behave very different than they do today. Let's examine some of the actions that will be needed for this phase of the evolution to occur.

- **Collaboration and Regionalization.** Of all the actions needed for emergency communications ecosystem evolution to continue, this is by far the most important—it speaks directly to the cell-merger analogy described earlier in this whitepaper. PSAPs no longer can afford to be siloed. Rather, they need to work collaboratively, ideally across an entire region or between multiple regions, to enable data sharing, to leverage economies of scale, and to improve resiliency.

  From an operational perspective, the benefits of collaboration and regionalization include improved emergency services delivery because of increased standardization and flexibility and the use of intelligent systems. Additional benefits include improved management, utilization of workforce resources and agile organizational structures.

---

[1] (National Public Safety Telecommunications Council, 2014)

CRISIS COMMUNICATIONS
THEN & NOW

THEN

EVENT

RESPONDERS

MEDIA

NOW

MissionCriticalPartners

From a technical perspective, the ecosystem will benefit from improvements in upgrades and change management, disaster recovery and backup.

And, finally, from a financial perspective, collaboration and regionalization results in lower IT management costs by reducing the number of servers, workstation equipment, and network infrastructure that staff must support. Less equipment also can result in reduced facilities costs such as electricity.

Holistic thinking about the entire public safety communications ecosystem is critical, as every application and system in the process affects everything else in some manner.

- **Holistic Thinking.** This action is corollary to collaboration and regionalization, which depend on the ability to see, understand and embrace the big picture. This applies not only to interactions between other PSAPs within a region, but also to the PSAP's networks and systems, and perhaps partnerships with private- and public-sector entities that exist outside of public safety's ecosystem. Simply put, everything affects everything else in some manner.

- **Staffing and Training.** PSAP leadership needs to start seeking telecommunicators with very different skillsets, perhaps the ability to analyze data; or PSAPs may need to create new positions, the data-focused telecommunicator, whose focus will not be on traditional call-handling, but rather, managing the data that flows into the 911 center from smartphones, sensors and the like. Regardless, PSAPs need to start rethinking how they screen and hire candidates going forward. In addition, future telecommunicators likely will encounter stresses that are not present today. For example, they will begin to see things, in the form of video, that previously only first responders in the field saw—how will they react the first time they see images from a multi-fatality car accident? Training regimens and post-incident stress debriefings will need to evolve to address the new realities.

- **Subject-Matter Expertise.** The evolution of the emergency communications ecosystem will have many moving parts and at times will resemble a spider web. Very few PSAPs will have the resources and expertise to manage internally every aspect of what most assuredly will be a complex evolution. Consequently, it is advised that PSAPs engage subject-matter experts (SMEs) who do possess the across-the-board expertise, experience and skillsets needed to navigate the migration and to maintain a focus on the big picture.

- **Migration to IP-based Systems.** We live in a world dominated by digital and IP-based technology and PSAPs need to join it by implementing call-handling and CAD systems that are compliant with the National Emergency Number Association (NENA) i3 standards. This will eliminate the aforementioned digital-to-analog conversion that currently takes place when a PSAP receives a 911 call from a wireless or VoIP device, but also, more importantly, will lay the foundation for fielding calls in a NG911 environment. In addition, IP-based technology enables seamless data sharing and provides the ability to take advantage of cloud-based, hosted solutions that reduce implementation, operations and maintenance costs.

- **Integration of NG911 and the NPSBN.** Both networks will generate a tsunami of data— including many new types—that will improve situational awareness and emergency response dramatically. But the only way to ensure that the information will be pushed to first responders in the field from PSAPs, and vice versa, seamlessly and in real-time, is to integrate the networks to create a unified communications platform.

MissionCriticalPartners

- **Other System Upgrades.** Records management and data storage systems need to be upgraded to ensure that they can handle data volumes that are sure to mushroom. PSAPs also need to balance data security with enabling accessibility for personnel whenever needed. Data needs to be shareable with other agencies, for instance, to enable predictive policing. Regarding video, care must be taken concerning how the data is compressed and stored, to guarantee that it is court-admissible. Further, implementation of data analytics systems is essential, because PSAPs lack the personnel necessary to manually process all the data that will be coming its way in the future.

Conclusion

The evolution of the emergency communications ecosystem continues, but needs to accelerate dramatically to take advantage of emerging opportunities. Data has overtaken voice in importance, and a treasure trove of information already exists that would improve situational awareness and thus emergency response. But this data remains beyond the grasp of public safety answering points (PSAPs) because they remain saddled with antiquated communications networks, systems and equipment, and in some cases, hampered by antiquated thinking. While the evolution will be challenging and even frightening at times, it is essential for PSAPs to take advantage of the advances in modern communications tools that will help them find ways to proactively respond to environmental factors. As a result, they will become stronger, more resilient, and better prepared to meet the changed expectations of those they serve.

Evolving our nation's 911 system will make public safety stronger, more resilient and better prepared to meet the new expectations of the public.

MissionCriticalPartners